TRANSACTIONS
OF THE
ROYAL SOCIETY OF NEW ZEALAND

ZOOLOGY

VOL. 3 NO. 13 MAY 24, 1963

A New Family and Genus of Somasteroidea

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[*Received by the Editor, December 13, 1962.*]

Abstract

SKELETAL structure indicating the presence of internal ampullae (previously unrecognised in Palaeozoic Asterozoa) occurs in two genera of lower Ordovician Somasteroidea, in which also the metapinnules are differentiated into marginal, actinal intermediate and adambulacral virgalia. These characters require the definition of a new family, for which *Villebrunaster* Spencer is selected as type.

ON the initiative of Professor George Ubaghs, University of Liège, and with the kind co-operation of Professor H. Gauthier, University of Lyons, a series of positive latex moulds of the lower Palaeozoic somasteroids held at the University of Lyons has been prepared to permit a study of the morphology of these ancient sea-stars. The results will be reported later, but in the meantime it is desirable to record the existence of an undescribed genus, and to indicate its systematic position. A new family is required to accommodate the genus, as also *Villebrunaster* Spencer, the characters of which have been incorrectly given in the existing literature.

SUBPHYLUM ASTEROZOA
Class STELLEROIDEA
Subclass SOMASTEROIDEA
Family VILLEBRUNASTERIDAE NOV.

Arms petaloid, separated proximally by a deep interradial cleft which extends to the perignathic region. Tube-feet unplated, housed (over the greater part of the arm) on sunken shelf-like cupules carried on the abradial surface of the capitula, and bordered by the adjacent lateral wings of the ambulacrals, communicating with the coelomic cavity, presumably for internal ampullae. Virgalia of the metapinnules differentiated as adambulacral, intermediate and marginal elements, though in general retaining a transversely elongate form. No marginal radioles, no occluded superambulacral ossicles; the intermediate virgalia forming the vertical walls of the actinal interpinnular grooves, apparently without cover-plates. Adambulacral virgalium placed more or less obliquely with respect to its metapinnule, tending to lie parallel to the radius, and having the distal extremity of the ambulacral wing resting lightly upon it. Capitula of the ambulacrals completely enclosing the radial water-vessel, not erectile upon the adambulacral. Food-groove open, bordered by the adambulacrals; the major axis of the ambulacral ossicle lying horizontally. Jaw (known in *Villebrunaster* only) composed of three pairs of ambulacral elements, of which the first is the oral angle-plate, and the second and third are united in syzygy. No oral pinnule.

Published by the Royal Society of New Zealand, c/o Victoria University of Wellington, P.O. Box 196, Wellington.

Type genus, *Villebrunaster* Spencer, 1951. Type species, *Villebrunaster thorali* Spencer, 1951, from the lower Ordovician of France.

The characters of *Villebrunaster* were incorrectly given by Spencer (1951, p. 92-94, Fig. 1). In his figure of *V. thorali* (Spencer, 1951, p. 92) no marginal or adambulacral virgalia are shown, and the long lateral wings of the ambulacrals are omitted from the distal part of the arm. The figure is said to be based on the holotype, which is shown, with a paratype, in Plate 2, fig. 29, of the paper cited. Comparison of Fig. 29 (a photograph of the block containing the types) with the actual types shows that Spencer apparently had only an incomplete positive mould, from which the marginal region and the distal parts of the arms had been omitted. Spencer did, however, illustrate the shelf-like character of the reduced cupule in the middle part of the arm (Spencer, *loc. cit.*, Figure 4), though without illustrating the relationship to the adjoining structures. He indicated his belief that *Villebrunaster*, like all other Palaeozoic asterozoans, had closed external cupules, and that accordingly there were no internal ampullae. With this conclusion I do not agree. As will be seen from Fig. 1 of this paper, the base of the tube-foot in Villebrunasteridae lay in direct proximity to a perforation bounded by the adjacent ambulacral wings, and by the adjacent adambulacral virgalium, and the arrangement of the skeletal structures is directly comparable to that found in *Platasterias*, where an internal ampulla is developed through the perforation. There can be little doubt that a similar development had occurred in Villebrunasteridae. Thus, as early as the lower Ordovician, a stock of asterozoans had differentiated having many of the characters of modern asteroids.

The family Chinianasteridae, as now restricted by the exclusion of *Villebrunaster*, differ from Villebrunasteridae in several important respects, not recorded by Spencer. On receiving from me a preliminary account of *Platasterias*, Professor Ubaghs examined the types of *Chinianaster*, and wrote to inform me that he could observe some of the characters of *Platasterias* in that genus also. These included: the presence of lateral flanges on the virgalia; the presence of a double series of flattened quadrangular cover-plates, carried on the flanges; the presence of free terminal radioles; and pointed tube-feet. On receiving the material of *Chinianaster* I was able to confirm these observations, and then asked Professor Ubaghs to announce them; he, however, generously has preferred to allow me to do this. It is clear that the inferred structure of the fossils, derived from study of *Platasterias*, has been confirmed. Other important differences between Chinianasteridae and Villebrunasteridae include the undifferentiated virgalia of the former, and the fact that the cupule in Chinianasteridae lies on the adoral surface of the capitulum, which develops no wing. As will shortly be recorded elsewhere, the jaw-structure of Chinianasteridae, Villebrunasteridae and Platasteriidae is fundamentally the same.

The Platasteriidae resemble Villebrunasteridae in having differentiated virgalia, and cupules which communicate with the body-cavity between the wings of the ambulacrals. They differ in having coverplates, in having the virgalia stabilised as 4 elements in each metapinnule, the second virgalium being occluded as a superambulacral ossicle, in having longer ambulacral wings, which rest along the upper surface of the elongate adambulacral virgalia, and having a fulcrum-mechanism at the outer end of the adambulacral, permitting erection of a temporary furrow of asteroid type.

In addition to *Villebrunaster*, a second genus of Villebrunasteridae may be distinguished as follows:—

Ampullaster ubaghsi sp. nov., holotype, positive mould of adoral aspect, prepared by G. Ubaghs, photographed by M. D. King. Magnification, 4 diameters.

Photo: M. D. King.

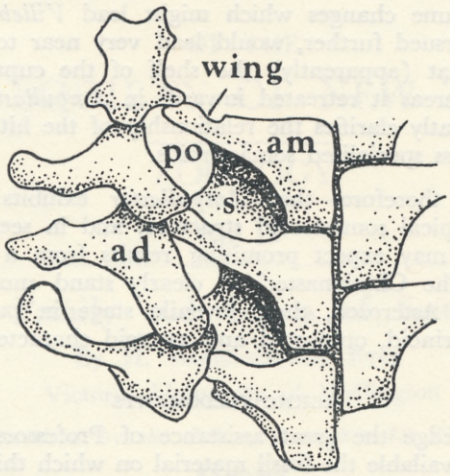

FIG. 1.—*Ampullaster ubaghsi* sp. nov. Distal portion of a radius, × 15, adoral aspect, holotype. Abbreviations: ad, adambulacral (virgalium-1); am, capitulum of ambulacral; po, pore for presumed ampulla; s, shelf of sunken cupule; wing, wing of ambulacral. Some post-mortem displacement of the lowest adambulacral has occurred.

Ampullaster n.g.

Arms of rhombic outline, separated by deep, narrow interradial slits, and combining thus to impart an overall pentagonal outline to the body. Proximal metapinnules composed of slender virgalia, except for the first element of each series, which is enlarged to form an adambulacral. Distal metapinnules robust, comprising relatively few and strong virgalia, the proximal element of each series enlarged as an adambulacral, and the distal element of each series as a marginal. The marginals not forming a continuous ambital series, being separated into five similar V-shaped groups by the interradial slits, each V-shaped group corresponding to the outer angle of the rhombic outline of the arms. Adambulacrals arranged throughout the arm in longitudinal (adradial) series.

TYPE SPECIES. *Ampullaster ubaghsi* sp. nov., having the characters of the genus, no other species being known. Holotype PS 193, in the University of Lyons Palaeontological Collection, France. Collected from the environs of St. Chinian (Heralt), southern France, by the late Professor M. Thoral. R. 19 mm; r, 15 mm.

HORIZON. Lowest Ordovician.

The unusually excellent state of preservation of the holotype has greatly aided the interpretation of the related genus *Villebrunaster*, where similar (though less conspicuous) differentiation of the virgalia occurs. *Villebrunaster* differs from *Ampullaster* in having closed cupules carried on the adoral surface of the capitula of the proximal 4 or 5 ambulacrals; in the leaf-shaped outline of the arms; in the consequent absence of a distinct pentagonal outline to the body; in the less conspicuous differentiation of the virgalia; and in the more variable form of the ambulacrals, the shape of which changes considerably along the course of the arm, wings being developed only in the distal half.

The genus *Archegonaster* (Fam. Archegonasteridae) resembles *Ampullaster* in its pentagonal body-shape, differentiated marginals, conspicuous adambulacrals, and robust distal virgalia. It differs from *Ampullaster* in having a continuous (and more robust) marginal series, without interradial slits; in having adambulacral spines; and in having lost all trace of the proximal metapinnules (save for their adambulacrals). When *Villebrunaster* and *Ampullaster* are compared,

it is seen that the same changes which might lead *Villebrunaster* to give rise to *Ampullaster*, if pursued further, would lead very near to *Archegonaster*; with the sole difference that (apparently) the shelf of the cupule became expanded in *Archegonaster*, whereas it retreated inwards in *Ampullaster*. I think that this simple assumption greatly clarifies the relationship of the hitherto puzzling Archegonasteridae to the less specialised somasteroids.

It will be seen, therefore, that *Ampullaster* exhibits generalised asteroid features as well as typical somasteroid structure, and in seeking the ancestors of modern asteroids we may expect promising results from a further study of the Villebrunasteridae. The Chinianasteridae clearly stand much nearer the archetypal pattern for all Asterozoa, their juvenile stage in particular presenting a strange mingling of crinoid, ophiuroid and asteroid characters.

ACKNOWLEDGMENTS

I beg to acknowledge the great assistance of Professors G. Ubaghs and H. Gauthier in making available the fossil material on which this, and related studies, are based. The work is being supported by a grant from the Research Fund of Victoria University of Wellington. The photograph (Plate 1) was made by Mr M. D. King, Victoria University of Wellington.

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